

## **WHAT IS CLAIMED IS:**

1. A hydraulic control system of a six-speed automatic transmission for a vehicle comprising:

5 a line pressure control portion stably maintaining hydraulic pressure supplied from an oil pump and varying a line pressure according to driving conditions;

a launch control portion for controlling torque increase of a torque converter and for controlling a damper clutch;

10 a pressure reduction control portion for reducing line pressure and for outputting the reduced line pressure as control pressure;

15 a switch valve control portion comprising a manual valve for changing hydraulic lines according to a manual operation, a first switch valve controlled by the line pressure and a first on/off solenoid valve, a second switch valve controlled by the line pressure and a second on/off solenoid valve, and third and fourth switch valves being controlled by the line pressure and control pressure from the second switch valve;

20 a first clutch control portion comprising a first clutch side switch valve and a first clutch side pressure control valve that are controlled by a first duty control solenoid valve such that the first clutch control portion controls an operating pressure of the first clutch;

25 a B1/C3 control portion comprising a third clutch side switch valve and a third clutch side pressure control valve that are controlled by a second duty control solenoid valve, a control valve for switching hydraulic lines for hydraulic pressure supplied from the third clutch side pressure control valve, and a first brake side fail-safe valve for supplying hydraulic pressure received from the control valve to the first brake and for executing a fail-safe function;

30 a second clutch control portion comprising a second clutch side switch valve and a second clutch side pressure control valve that are controlled by a third duty control solenoid valve, and a second clutch side fail-safe valve for transmitting hydraulic pressure received from the second clutch side pressure control valve to the second clutch and for executing a fail-safe function;

35 a B2 control portion comprising a second brake side switch valve and a second brake side pressure control valve that are controlled by a fourth duty control solenoid valve, a sixth-speed-related switch valve for supplying, under the control of the operating pressure of the third clutch, hydraulic pressure received from the fourth duty control solenoid valve to the

second brake side pressure control valve as a control pressure, and a second brake side fail-safe valve for transmitting hydraulic pressure received from the second brake side pressure control valve to the second brake and for executing a fail-safe function.

2. The hydraulic control system of claim 1, wherein the manual valve

5 comprises:

a line pressure line connected to a regulator valve;

a reverse speed pressure line for supplying a reverse speed pressure in a reverse speed; and

10 a forward speed pressure line for supplying a forward speed pressure in forward speeds.

3. The hydraulic control system of claim 1, wherein the first switch valve comprises a valve body and a valve spool,

wherein the valve body of the first switch valve comprises:

a first port for receiving a control pressure from the first on/off solenoid valve;

15 a second port disposed opposite to the first port for receiving the line pressure as a control pressure;

a third port for receiving the line pressure; and

20 fourth and fifth ports disposed with a predetermined spacing for supplying hydraulic pressure received through the first port selectively to two ports of the second switch valve,

25 and

the valve spool of the first switch valve comprises:

a first land for receiving a control pressure through the first port;

a second land for selectively communicating the fifth port with an exhaust port;

a third land cooperating with the second land for selectively communicating the third

25 port with the fifth port cooperatively with the second land; and

a fourth land for receiving a control pressure through the second port and for selectively communicating the third port with the fourth port cooperatively with the third land and for selectively communicating the fourth port with an exhaust port.

4. The hydraulic control system of claim 1, wherein the second switch valve

30 comprises a valve body and a valve spool,

wherein the valve body of the second switch valve comprises:

a first port for receiving a control pressure from the second on/off solenoid valve;

a second port disposed opposite to the first port for receiving the line pressure as a control pressure;

a third port for receiving hydraulic pressure from the fourth port of the first switch valve;

5 a fourth port for receiving hydraulic pressure from the fifth port of the first switch valve;

a fifth port for supplying hydraulic pressure of the third port to the control valve as a control pressure;

10 a sixth port for supplying hydraulic pressure of the third port to the third switch valve as a control pressure; and

a seventh port for supplying hydraulic pressure of the fourth port to the fourth switch valve as a control pressure, and

the valve spool of the second switch valve comprises:

a first land for receiving a control pressure through the first port;

15 a second land for selectively communicating the fifth port with an exhaust port;

a third land for selectively communicating the third port with the fifth and sixth ports and;

a fourth land cooperating with the third land for selectively communicating the sixth port with an exhaust port; and

20 a fifth land cooperating with the fourth land for selectively communicating the fourth port with the seventh port.

5. The hydraulic control system of claim 1, wherein the third switch valve comprises a valve body and a valve spool,

wherein the valve body of the third switch valve comprises:

25 a first port for receiving the line pressure as a control pressure;

a second port disposed opposite to the first port for receiving a control pressure from the second switch valve;

a third port disposed adjacent to the second port for receiving an operating pressure of the first clutch as a control pressure;

30 a fourth port disposed adjacent to the third port for receiving an operating pressure of the third clutch as a control pressure;

a fifth port for receiving the line pressure as a source pressure;

a sixth port for selectively supplying hydraulic pressure of the fifth port to the second clutch side pressure control valve; and

a seventh port for exhausting hydraulic pressure that has been output through the sixth port, and

5 the valve spool of the third switch valve comprises:

a first land for receiving a control pressure through the first port;

a second land for selectively communicating the sixth port with the seventh port;

a third land for selectively communicating the fifth port with the sixth port;

a fourth land for receiving a control pressure through the fourth port; and

10 a fifth land for receiving a control pressure through the third port,

wherein an elastic member is disposed to a side of the fifth land.

6. The hydraulic control system of claim 1, wherein the fourth switch valve comprises a valve body and a valve spool,

wherein the valve body of the fourth switch valve comprises:

15 a first port for receiving the line pressure as a control pressure;

a second port disposed opposite to the first port for receiving a control pressure from the second switch valve;

a third port disposed adjacent to the second port for receiving an operating pressure of the first clutch as a control pressure;

20 a fourth port disposed adjacent to the third port for receiving an operating pressure of the third clutch as a control pressure;

a fifth port for receiving the line pressure as a source pressure;

a sixth port for selectively supplying hydraulic pressure of the fifth port to the second brake side pressure control valve; and

25 a seventh port for exhausting hydraulic pressure that has been output through the sixth port, and

the valve spool of the fourth switch valve comprises:

a first land for receiving a control pressure through the first port;

a second land for selectively communicating the sixth port with the seventh port;

30 a third land for selectively communicating the fifth port with the sixth port;

a fourth land for receiving a control pressure through the fourth port; and

a fifth land for receiving a control pressure through the third port,

wherein an elastic member is disposed to a side of the fifth land.

7. The hydraulic control system of claim 1, wherein the first clutch side switch valve comprises a valve body and a valve spool,

wherein the valve body of the first clutch side switch valve comprises:

a first port for receiving a control pressure from the first duty control solenoid valve;

5 a second port disposed opposite to the first port for receiving the reduced pressure of the reducing valve as control pressure;

a third port for receiving the line pressure as a source pressure; and

a fourth port for supplying hydraulic pressure of the third port to the first clutch side pressure control valve, and

10 the valve spool of the first clutch side switch valve comprises:

a first land for receiving a control pressure through the first port; and

a second land for receiving a control pressure through the second port and for selectively communicating the third port with the fourth port cooperatively with the first land, wherein an elastic member is disposed to a side of the first land.

15 8. The hydraulic control system of claim 1, wherein the first clutch side pressure control valve comprises a valve body, a valve spool disposed therein, and a cup for safely maintaining a moved position of the valve spool,

wherein the valve body of the first clutch side pressure control valve comprises:

a first port for receiving a control pressure from the first clutch side switch valve;

20 a second port for receiving a control pressure from the first duty control solenoid valve;

a third port for receiving a reduced pressure of the reducing valve as a control pressure;

a fourth port for receiving a forward speed pressure from the manual valve;

25 a fifth port for supplying hydraulic pressure of the fourth port to the first clutch; and

a sixth port for exhausting hydraulic pressure that has been output through the fifth port, and

the valve spool of the first clutch side pressure control valve comprises

a first land for receiving control pressure fed through the second port and for

30 selectively opening the sixth port; and

a second land for receiving a control pressure through the third port and for selectively communicating the fourth port with the fifth port cooperatively with the first land,

wherein the valve spool is disposed in the valve body interposing an elastic member and the cup for receiving control pressure fed through the first port.

9. The hydraulic control system of claim 1, wherein the third clutch side switch valve comprises a valve body and a valve spool,

5 wherein the valve body of the third clutch side switch valve comprises:

a first port for receiving a control pressure from the second duty control solenoid valve;

a second port disposed opposite to the first port for receiving the reduced pressure of the reducing valve as a control pressure;

10 a third port for receiving the line pressure as a source pressure; and

a fourth port for supplying hydraulic pressure of the third port to the third clutch side pressure control valve, and

the valve spool of the third clutch side switch valve comprises

a first land for receiving a control pressure through the first port; and

15 a second land for receiving a control pressure through the second port and for selectively communicating the third port with the fourth port cooperatively with the first land, wherein an elastic member is disposed to a side of the first land.

10. The hydraulic control system of claim 1, wherein the third clutch side pressure control valve comprises a valve body, a valve spool disposed therein, and a floating member for safely maintaining a moved position of the valve spool,

wherein the valve body of the third clutch side pressure control valve comprises:

a first port for receiving a control pressure from the third clutch side switch valve;

a second port for receiving a control pressure from the second duty control solenoid valve;

25 a third port for receiving a reduced pressure of the reducing valve as a control pressure;

a fourth port for receiving a forward speed pressure from the manual valve;

a fifth port for supplying hydraulic pressure of the fourth port to the control valve; and a sixth port for exhausting hydraulic pressure that has been output through the fifth

30 port, and

the valve spool of the third clutch side pressure control valve comprises:

a first land for receiving control pressure fed through the second port and for selectively opening the sixth port;

a second land for receiving a control pressure through the third port and for selectively communicating the fourth port with the fifth port cooperatively with the first land;

5 and

a third land for receiving control pressure fed through the third port,

wherein the valve spool is disposed in the valve body interposing an elastic member and the floating member for receiving control pressure fed through the first port.

11. The hydraulic control system of claim 1, wherein the control valve 10 comprises a valve body and a valve spool,

wherein the valve body of the control valve comprises:

a first port for receiving the line pressure as a control pressure;

a second port disposed opposite to the first port for receiving a control pressure from the second switch valve;

15 a third port for receiving an operating pressure of the first clutch as a control pressure;

a fourth port for receiving an operating pressure of the third clutch side pressure control valve;

a fifth port for selectively supplying hydraulic pressure fed through the fourth port to the third clutch;

20 a sixth port disposed between the first port and the fourth port for selectively exhausting hydraulic pressure that has been output through the fifth port;

a seventh port disposed between the third port and fifth port and connected to the first brake side switch valve; and

25 an eighth port for exhausting hydraulic pressure that has been exhausted from the seventh port, and

the valve spool of the control valve comprises:

a first land for receiving a control pressure through the first port and for selectively opening the sixth port;

a second land for selectively communicating the fourth port with the fifth port;

30 a third land for selectively communicating the seventh port with the eighth port;

a fourth land for receiving a control pressure through the third port; and

a fifth land for receiving a control pressure through the second port.

12. The hydraulic control system of claim 1, wherein the first brake side fail-safe valve comprises a valve body and a valve spool,

wherein the valve body of the first brake side fail-safe valve comprises:

a first port for receiving the line pressure as a control pressure;

5 a second port communicating with the seventh port of the control valve;

a third port for supplying hydraulic pressure fed through the second port to the first  
brake;

a fourth port for exhausting hydraulic pressure exhausted from the third port;

10 a fifth port for receiving operating pressure of the second brake as a control pressure;

a sixth port for receiving operating pressure of the second clutch as a control pressure;

a seventh port for receiving operating pressure of the first clutch as a control pressure;

and

an eighth port for receiving reverse speed pressure as a control pressure, and

the valve spool of the first brake side fail-safe valve comprises:

15 a first land for receiving a control pressure through the first port;

a second land adjacent to the first land;

a third land for selectively communicating the third port with the second and fourth  
ports;

a fourth land for receiving control pressure through the fifth port, and cooperatively

20 with the third land, for selectively communicating the third port with the fourth port;

a fifth land for receiving control pressure through the sixth port;

a sixth land for receiving control pressure through the seventh port; and

a seventh land for receiving control pressure through the eighth port.

13. The hydraulic control system of claim 1, wherein the second clutch side

25 switch valve comprises a valve body and a valve spool,

wherein the valve body of the second clutch side switch valve comprises:

a first port for receiving a control pressure from the third duty control solenoid valve;

a second port disposed opposite to the first port for receiving the reduced pressure of  
the reducing valve as a control pressure;

30 a third port for receiving the line pressure as a source pressure; and

a fourth port for supplying hydraulic pressure of the third port to the second clutch  
side pressure control valve, and

the valve spool of the second clutch side switch valve comprises:

a first land for receiving a control pressure through the first port; and  
a second land for receiving a control pressure through the second port and for  
selectively communicating the third port with the fourth port cooperatively with the first land,  
wherein an elastic member is disposed to a side of the first land.

5        14.        The hydraulic control system of claim 1, wherein the second clutch side  
pressure control valve comprises a valve body, a valve spool disposed therein, and a floating  
member for safely maintaining a moved position of the valve spool,  
wherein the valve body of the second clutch side pressure control valve comprises:  
a first port for receiving a control pressure from the second clutch side switch valve;  
10        a second port for receiving a control pressure from the third duty control solenoid  
valve;  
a third port for receiving a reduced pressure of the reducing valve as a control  
pressure;  
a fourth port for receiving a hydraulic pressure from the third switch valve;  
15        a fifth port for supplying hydraulic pressure of the fourth port to the second clutch  
fail-safe valve; and  
a sixth port for exhausting hydraulic pressure that has been output through the fifth  
port, and  
the valve spool of the second clutch side pressure control valve comprises  
20        a first land for receiving control pressure fed through the second port and selectively  
opening the sixth port;  
a second land for receiving a control pressure through the third port and for  
selectively communicating the fourth port with the fifth port cooperatively with the first land;  
and  
25        a third land for receiving control pressure fed through the third port,  
wherein the valve spool is disposed in the valve body interposing an elastic member  
and the floating member for receiving control pressure fed through the first port.

15.        The hydraulic control system of claim 1, wherein the second clutch side  
fail-safe valve comprises a valve body and a valve spool,  
30        wherein the valve body of the second clutch side fail-safe valve comprises:  
a first port for receiving the line pressure as a control pressure;

a second port communicating with the fifth port of the second clutch side pressure control valve;

a third port for supplying hydraulic pressure fed through the second port to the second clutch;

5 a fourth port for exhausting hydraulic pressure exhausted from the third port;

a fifth port for receiving operating pressure of the third clutch as a control pressure; and

a sixth port for receiving operating pressure of the first clutch as a control pressure, and

10 the valve spool of the second clutch side fail-safe valve comprises:

a first land for receiving a control pressure through the first port;

a second land adjacent to the first land;

a third land for selectively communicating the third port with the second and fourth ports and;

15 a fourth land for receiving control pressure through the fifth port, and cooperatively with the third land, for selectively communicating the third port with the fourth port;

a fifth land for receiving control pressure through the sixth port; and

a sixth land for receiving control pressure through the sixth port together with the fifth land.

20 16. The hydraulic control system of claim 1, wherein the second brake side switch valve comprises a valve body and a valve spool,

wherein the valve body of the second clutch side switch valve comprises:

a first port for receiving a control pressure from the fourth duty control solenoid valve;

25 a second port disposed opposite to the first port for receiving the reduced pressure of the reducing valve as a control pressure;

a third port for receiving the line pressure as a source pressure; and

a fourth port for supplying hydraulic pressure of the third port to the second brake side pressure control valve, and

30 the valve spool of the second brake side switch valve comprises:

a first land for receiving a control pressure through the first port; and

a second land for receiving a control pressure through the second port and for selectively communicating the third port with the fourth port cooperatively with the first land,

wherein an elastic member is disposed to a side of the first land.

17. The hydraulic control system of claim 1, wherein the second brake side control valve comprises a valve body, a valve spool disposed therein, and a floating member for safely maintaining a moved position of the valve spool,

5       wherein the valve body of the second brake side pressure control valve comprises:  
a first port for receiving a control pressure from the second brake side switch valve;  
a second port for receiving a control pressure from the fourth duty control solenoid valve;

10      a third port for receiving a reduced pressure of the reducing valve as a control pressure;

      a fourth port for receiving a hydraulic pressure from the fourth switch valve;  
      a fifth port for supplying hydraulic pressure of the fourth port to the second brake side fail-safe valve;

15      a sixth port for exhausting hydraulic pressure that has been output through the fifth port; and

      a seventh port for receiving control pressure from the sixth-speed-related switch valve, and

      the valve spool of the second brake side pressure control valve comprises:

      a first land for receiving control pressure fed through the second port and for

20      selectively opening the sixth port;

      a second land for receiving a control pressure through the third port and for selectively communicating the fourth port with the fifth port cooperatively with the first land;

      a third land for receiving control pressure fed through the third port; and

      a fourth land for receiving control pressure from the sixth-speed-related switch valve,

25      wherein the valve spool is disposed in the valve body interposing an elastic member and the floating member for receiving control pressure fed through the first port.

18. The hydraulic control system of claim 1, wherein the sixth-speed-related switch valve comprises a valve body and a valve spool,

      wherein the valve body of the sixth-speed-related switch valve comprises:

30      a first port for receiving the operating pressure of the third clutch as a control pressure;

a second port for receiving a control pressure controlled by the fourth duty control solenoid valve; and

a third port for supplying hydraulic pressure fed through the second port to the second brake side pressure control valve as a control pressure thereof, and

5 the valve spool of the sixth-speed-related switch valve comprises

a first land for receiving a control pressure through the first port; and

a second land selectively communicating the second port with the third port, wherein an elastic member is disposed to a side of the second land.

19. The hydraulic control system of claim 1, wherein the second brake side fail-safe valve comprises a valve body and a valve spool,

wherein the valve body of the second brake side fail-safe valve comprises:

a first port for receiving the line pressure as a control pressure;

a second port communicating with the fifth port of the second brake side pressure control valve;

15 a third port for supplying hydraulic pressure fed through the second port to the second brake;

a fourth port for exhausting hydraulic pressure exhausted from the third port;

a fifth port for receiving operating pressure of the second brake as a control pressure;

a sixth port for receiving operating pressure of the third clutch as a control pressure;

20 a seventh port for receiving operating pressure of the first clutch as a control pressure; and

an eighth port for receiving operating pressure of the first brake as a control pressure, and

the valve spool of the second brake side fail-safe valve comprises:

25 a first land for receiving a control pressure through the first port;

a second land adjacent to the first land;

a third land for selectively communicating the third port with the second and fourth ports;

a fourth land for receiving control pressure through the fifth port and selectively

30 communicating the third port with the fourth port cooperatively with the third land;

a fifth land for receiving control pressure through the sixth port;

a sixth land for receiving control pressure through the seventh port; and

a seventh land for receiving control pressure through the eighth port.